

REMARKS

Claims 1, 2, 4-7, 9, 10, and 12 are pending in the present Application. Claims 2, 4, 7, 9, 10, and 12 have been canceled, Claims 1 and 5 have been amended, and no claims have been added, leaving Claims 1, 5, and 6 for consideration upon entry of the present Amendment. Reference to the i

Amendments to Claims

Claim 1 has been amended to include the limitations of Claims 2 and 4, canceled herewith, and Claim 5 has been amended to include the limitations of Claims 10 and 12, canceled herewith, to include the limitation of coating by gravure coating, and to include the specific gel polymers. Claims 1 and 5 have further been amended to include the gel coating thickness of 1 to 2 micrometers, support for which can be found in the Specification on p. 8, line 30 to p. 9, line 6.

Claims 7 and 9 have each been canceled as for being redundant to the limitations of Claim 5 (noting that Claims 7 and 9 depend from Claim 6, and that Claim 6 depends from Claim 5).

Reconsideration and allowance of the claims are respectfully requested in view of the above amendments and the following remarks.

Claim Rejections Under 35 U.S.C. § 102(b)/103(a)

Claims 1, 5, and 6 stand rejected under 35 U.S.C. § 102(b) as allegedly anticipated by European Patent No. 0 9982 790 (“Yoshida”).

Claims 2, 7, and 10 stand rejected under 35 U.S.C. § 102(b) as allegedly anticipated by, or in the alternative, under 35 U.S.C. § 103(a) as allegedly unpatentable over Yoshida.

Claims 4, 9, and 12 stand rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over Yoshida in view of U.S. Patent Publication No. 2002/0061449 (“Maruo”).

Applicants respectfully traverse these rejections.

To anticipate a claim, a reference must disclose each and every element of the claim. *Lewmar Marine v. Variet Inc.*, 3 U.S.P.Q.2d 1766 (Fed. Cir. 1987).

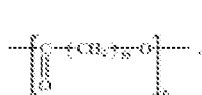
Claims 1 and 5, as amended, include the limitations of Claims 4 and 9, respectively

(also noting the incorporation of the limitations of Claims 2 and 10 into Claims 1 and 5, respectively). As neither of these claims is rejected as anticipated by Yoshida, Yoshida therefore fails to disclose all elements of Claims 1 and 5 as amended to include the limitations of Claims 4 and 9, and does not suggest the missing elements provided by these claims.

Applicants therefore respectfully request the Examiner withdraw the anticipatory rejections of Claims 1 and 5 over Yoshida, and the obviousness rejections of Claims 2, 7, and 10 over Yoshida alone. Applicants will accordingly address the rejections of the remaining amended Claims 1, 5, and 6 as based on the combination of Yoshida in view of Maruo.

Regarding the rejection of the outstanding Claims 1 and 5 in view of the above amendments over Yoshida in view of Maruo, Yoshida discloses a separator 4 having an adhesive resin 6 partially coated on a separator 4 for joining electrodes 3 and 5 to the separator, where the adhesive resin 6 includes an at least partially plastic resin. Yoshida, Abstract, FIG. 1. The adhesive resin is not particularly limited as long as it is “[a]ny adhesive resin that does not dissolve in an electrolytic solution,” and may include polyolefins, polyglycols, and silicon resins. Yoshida, [0026]. The distance between each active material layer (i.e., layers 3 and 5) and the separator is 30 micrometers or smaller. Yoshida, [0020]. The total area of the voids 7 interspersed between the adhesive is 30 to 90%. Yoshida, [0027]. Yoshida discloses disposing a molten resin (6) by using a coater, in which a molten resin is picked up with a rotating roll having depressions and transferring them to a sheet (i.e., a separator) and while Yoshida states that the method of applying is not particularly limited, the only alternative method discussed is that of spray coating and roll coating by extruding molten resins through holes of a roll. Yoshida, [0029], specifically at Col. 6, line 59 to Col. 7, line 8.

Maruo discloses *electrode binders* or separators formed of a thermoplastic resin as an electrode binder with a controlled swelling range of 150-800%, Maruo, [0011]. The thermoplastic resin contains polyester units of formula (1):



such as in polycaprolactone, and is specifically a polyurethane prepared by reacting a polyol compound with a polyisocyanate compound and a chain extender, where a thermoplastic

polyurethane provides a suitable proportion of segments that interact with the electrolyte solution making it possible to control the swelling ration in the electrolyte solution within a suitable range of 150-800%. Maruo, [0040], [0057]-[0060]. Other thermoplastic resins (“any one or combinations of two or more”) “may be used together with the thermoplastic polyurethane resin,” and include fluoropolymers, synthetic rubbers, polyolefins, and polyethers. Maruo, [0062].

The instant Specification discloses that “[i]n a rechargeable lithium battery having the structural features claimed in the instant claims, a path for discharging gases generated from electrode reactions is provided by the presence of the claimed pattern, and thus, it is possible to prevent the gases from being trapped between each electrode and a separator so that an electrode assembly is maintained in a stable form and does not deform due to pressure build-up. In this way, it is possible to prevent premature deterioration of electrodes, thereby improving the battery life.” Specification, p. 7, lines 17-19; alternatively, see paragraphs [0015]-[0018]; [0032]-[0035] and Fig. 7 of the instant Specification published as US Patent Application Publication No. US 2007/0054183). It will be appreciated that the swellability and gel morphology are thus critical features of the polymer used in the instant claims.

“A patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.” *KSR Int’l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1741 (2007). To find obviousness, the Examiner must “identify a reason that would have prompted a person of ordinary skill in the art in the relevant field to combine the elements in the way the claimed new invention does.” *Id.*

The combination of Yoshida and Maruo fail to disclose all elements of the instant claims. Specifically, Yoshida fails to disclose the gel polymers claimed in Claims 1 and 5, and Maruo fails to teach or disclose these polymers, absent a thermoplastic polyurethane. Maruo discloses only that the disclosed polymers (see paragraph [0062] of Maruo) can be used in combination with the thermoplastic polyurethane. See e.g., Maruo, Synthesis Example 2 and Comparative Example 1, which is formed from a polyurethane with polyethylene oxide units and which swell excessively (1200%); compared with Synthesis Example 1, which is formed from a polyurethane having polycaprolactone ester units urethane linked to 1,4-butanediol but no polyether units such as polyethylene glycol units, and with

Synthesis Example 3 which contains polyurethane linked poly(ethylene oxide-propylene oxide) in Table 1, it can be seen that the essential common feature is the presence of polyurethane linkages, and that the polyether units are not essential to achieving the desired performance in Maruo as evidenced by Synthesis Example 1 and Example 1. Thus, Maruo does not disclose or provide evidence of polyethers absent polyurethanes. Claims 1 and 5, as amended, claim a “gel polymer [selected] from the group consisting of polyvinylidene fluoride (PVDF); polyethylene glycol diacrylate; polyalkylene glycol diacrylates; polyalkylene glycol dimethacrylates; ether polymers; carbonate polymers; acrylonitrile polymers; copolymers and crosslinked polymers consisting of at least two of them; and fluoropolymers.” Claims 1 and 5 do not claim polyurethanes.

Applicants respectfully submit that the Examiner, in arriving at this specific construction, has destroyed the intent of the references. In this regard, the courts have held that “[i]f the proposed modification would render the prior art invention being modified unsatisfactorily for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon* 733 F. 2d 900, 221 USPQ 1125 (Fed. Cir. 1984). The courts have also held that “[i]f the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims prima facie obvious.” *In re Ratti* 270 F. 2d 810, 123 USPQ 349 (CCPA 1959). To modify Yoshida with the polymers of Maruo, absent the teachings and evidence that Maruo apparently requires polyurethanes in addition to e.g., polyurethanes in order to achieve the results obtained therein, would both render Maruo unsatisfactory for its intended use of limited swelling, and would change the principle of operation of Maruo by removing an essential element. Further, Yoshida states in Col. 5, lines 47-49 (end of [0024]) that the plastic resin is solid and deforms on heating or pressure. The skilled artisan will appreciate that the solvent resistance required by the resin of Yoshida, in combination with the statement that the resin is solid and only thermally deformable (consistent with methods of adhering the separator to the electrodes in Yoshida) indicates that a resin deformable by solvent swelling is not desired, and therefore there is a further disincentive to modifying Yoshida with Maruo as to do so would render Yoshida unsuited to its intended purpose of providing a solvent-resistant adhesive for binding the

electrodes to the separator. Note that the instant Claims 1 and 5 require a gel polymer, which is by definition a solvent swellable polymer, as does Maruo; however, the adhesive in Yoshida has different requirements which preclude swelling. For these reasons at least, there is no suggestion or incentive to modify Yoshida with Maruo as to do so would require modifying each in a way not taught in the respective specifications, and so these references provide no expectation of success for the combination.

Furthermore, Yoshida and Maruo fail to disclose the specific combination of (i) a *regularly* patterned gel polymer layer in the range of 40-60% of a total separator area, and (ii) a uniformly formed and relatively thin gel polymer layer coated by a gravure coating method.

For an obviousness rejection to be proper, the Examiner must meet the burden of establishing that all elements of the invention are disclosed in the prior art; that the prior art relied upon, or knowledge generally available in the art at the time of the invention, must provide some suggestion or incentive that would have motivated the skilled artisan to modify a reference or combined references. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988).

Applicants point out that the separator has a gel polymer-coated part and a non-coated part in a regular patterned shape and the regularly formed gel polymer pattern is uniform and relatively thin (e.g., 1-2 μm), and therefore the electrode is uniformly impregnated with the electrolyte and the contact between the electrode and the separator area maintained uniformly, so that the electrode is totally and uniformly wetted with the electrolyte.

Therefore, uniform battery performance can be obtained and the battery life can be improved and also electrode reactions can be performed uniformly, thereby preventing lithium precipitation and improving battery safety (*see* paragraph [0061] of the instant Specification published as U.S. Patent Application Publication No. 2007/0054183). These advantageous features obtained by the claimed invention are not taught or suggested in Yoshida and Maruo. Thus, uniformity of the gel polymer pattern and well-regulated/controlled thickness thereof can only be achieved by relatively thin gel polymer layer coated by a gravure coating method (*see* e.g., paragraphs [0032]–[0035] of the instant Specification published as U.S. Patent Application Publication No. 2007/0054183).

In a rechargeable lithium battery having the structural features claimed in the instant claims, a path for discharging gases generated from electrode reactions is provided by the

presence of the claimed pattern, and thus, it is possible to prevent the gases from being trapped between each electrode and a separator so that an electrode assembly is maintained in a stable form and does not deform due to pressure build-up. In this way, it is possible to prevent premature deterioration of electrodes, thereby improving the battery life. The combination of Yoshida and Maruo fails to disclose the presence of a regular pattern in the gel polymer as claimed. Further, the method of application is significant in providing regular pattern according to the claimed invention which provides the unexpected benefits disclosed in the instant Specification.

Even if a prima facie case of obviousness were conceded, which it is not, it is respectfully submitted that applicant's invention is not obvious because the particular combination of claimed elements results in unexpectedly beneficial properties.

An applicant can rebut a prima facie case of obviousness by presenting comparative test data showing that the claimed invention possesses unexpectedly improved properties or properties that the prior art does not have. *In re Dillon*, 919 F.2d 688, 692-93, 16 U.S.P.Q.2d 1987, 1901 (Fed. Cir. 1990). See e.g., Comparative Examples 2 and 3 in the instant Specification and on pp. 11-12, and p. 6, line 23 to p. 7, line 7, in which the results of Comparative Example 2 (*dipping method*) and Comparative Example 3 (*gravure method*) are shown. Although these comparative data are concerned with a gel polymer totally coated on the separator, these experimental data show that a dipping method is better than the gravure coating method in terms of the discharging property shown in Figure 7. In view of these results, the combination of (i) regularly patterned gel polymer layer *and* (ii) a uniformly formed and relatively thin gel polymer layer coated by a gravure coating method is an unexpectedly advantageous feature.

Therefore, by use of a gravure method, it is possible to prevent premature deterioration of electrodes (due to high permeability afforded by other methods such as dip coating) while allowing gas permeability, thereby improving the battery life. Neither Yoshida nor Maruo disclose this feature. The present invention is thus nonobvious.

For these reasons at least, neither Yoshida nor Maruo discloses all elements of the instant claims, and the combination fails to provide a suggestion or incentive that would lead one skilled in the art to modify Yoshida and Maruo to provide a thermoplastic that includes

the claimed gel polymers absent the thermoplastic polyurethane required by Maruo, and further fails to provide a suggestion or incentive that would lead the skilled artisan to provide a gel polymer layer fabricated by gravure coating which in turn results in the desired and unexpected properties obtained in the examples of the instant specification.

Therefore, the combination of Yoshida and Maruo fails to render Claims 1, 5, and 6 (as amended) unpatentable. Reconsideration and allowance are respectfully requested.

Conclusion

It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicants. Accordingly, reconsideration and allowance are requested.

If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130.

Respectfully submitted,

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